

Planetary Defence and Collateral Damage

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Abstract

Near Earth Objects, NEOs, (asteroids, comets or similar celestial phenomena) can pose a threat to our planet. Although there is no known object threatening Earth at the moment, incidents such as the 2013 Chelyabinsk event have shown that there is a certain danger of NEOs being undetected for a considerable amount of time and hitting the planet Earth. Using currently existing technological means, our range of impact mitigation techniques is limited. Especially in the case of large masses, deflecting or destroying the incoming NEO with a nuclear explosive device might be the only feasible option. Moreover, for other objects destruction or deflection by conventional explosives or kinetic impactors might be humanity's only or last resort. As is frequently pointed out, the destruction or deflection of an asteroid might lead to certain collateral hazards. The asteroid could cause damage on its new (altered) trajectory or, if it has been blown to pieces, those pieces could cause damage on Earth or to spacecraft. This inevitably leads to the questions of responsibility and liability. Who (if anybody) is to be held accountable for any such damages? Can an asteroid or part thereof be considered a space object? If so, it has not been launched into space. Can any party involved in the planetary defence operation be considered a launching state?

I. Introduction

When a Near Earth Object is threatening the planet Earth, there is a certain range of options to counter that threat. One possible defensive measure would be to detonate a nuclear warhead on, above or slightly beneath the surface of the asteroid, in order to deflect and/or destroy that celestial body threatening the planet Earth. This might be the only measure to protect Earth from asteroids on short notice. However, there is still a number of alternative impact mitigation techniques such as kinetic impactors, gravity tractors, lasers that could boil off material from the surface of the asteroid.¹ It may depend on the specific circumstances which measures would be employed.²

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1 Clement, et al., Impact Hazard Mitigation: Understanding the Effects of Nuclear Explosive Outputs on Comets and Asteroids, Los Alamos National Laboratory.

Especially when being faced with large objects and only very little warning time, the nuclear option might be the only feasible one.³

Any of those impact mitigation techniques could lead to severe alterations of the trajectory or even the quality of the NEO. This might cause other kinds of damages than those that would have occurred had there not been a planetary defence mission.

The nature and quality of those damages can vary greatly. The asteroid could be completely destroyed and the ensuing debris might cause damages to spacecraft or installations on celestial bodies or even on the planet Earth. Damages of such a nature are of course not intended by the planners of the planetary defence mission.⁴

If the asteroid is being deflected, it might nonetheless inflict some harm on its new trajectory. The asteroid might, for example, cause damage somewhere else than initially projected after having been successfully deflected.

In case an NEO has been destroyed, further damage may be caused by the debris resulting from the destruction. Such damage might occur on the surface of the planet Earth, to aircraft in flight or to spacecraft in outer space.⁵

II. International Responsibility

According to Art VI OST, States Parties to the treaty bear international responsibility⁶ for their national activities in outer space.⁷ A planetary defence operation does constitute such an activity; therefore, the state carrying out such an activity bears international responsibility for said undertaking.⁸ If the operation were a multinational effort, Art VI OST would apply as well. In this case, the responsibility is borne by the states involved and the intergovernmental agency that may be concerned. It is rather unlikely that a planetary defence operation would be carried out by a non-governmental entity.⁹

Advanced Maui Optical and Space Surveillance Technologies Conference, September 2009, 2.

2 Ibid.

3 Nina-Louisa Remuss, *Space and security*, in: Brünner/Soucek, *Outer Space in Society, Politics and Law*. Vienna New York, 2011, 553.

4 Rinner et al., *Space Law Essentials Casebook*, Vol. 2, Vienna 2016, 53.

5 Kerrest/Smith in: Hobe Stephan /Bernhard Schmidt-Tedd/Kai-Uwe-Schrogl (eds), *Cologne Commentary on Space Law*, Vol. 1, Cologne 2009 (CoCoSL1), 126.

6 Soucek, *Space Law Essentials Textbook*, 24.

7 Gerhard in: CoCoSL1, 103.

8 Rinner et al., *Casebook*, Vol. 2, Vienna 2016, 53.

9 Gerhard in: CoCoSL1, 111.

It is, however, not clear how responsibility is to be attributed if an operation is carried out by a supra-national entity such as the European Union since such a case does not fall under Art VI sentence 3 OST.¹⁰

III. Liability

Art VII OST stipulates comprehensive state liability for damage that arises from the launch of a space object. Art VI and VII OST are meant to have the combined effect to ensure that states are both responsible and liable in damages towards other state parties and their nationals for their national space activities.¹¹ The Liability Convention is a *lex specialis* to the Outer Space Treaty and goes into further detail on the general principle of state liability for damages that result from a space object, anchored in Art. VII OST.¹²

Consequently, Art II LIAB stipulates that a launching state shall be absolutely liable for damage on the surface of the Earth or to aircraft in flight.

According to Art III LIAB launching states are only held absolutely liable for damages elsewhere than on the surface of the Earth (i.e. in space) if the damage is due to its fault.

Art VII OST restricts liability to a damage caused by a space object, but the term *space object* is not defined in the UN Space treaties. There is, however, an implicit understanding that a space object and a damage caused by it would have both physical and material properties.¹³ The Liability Convention includes reference to component parts of a space object as well as its launch vehicle and parts thereof. This does merely specify that individual parts or components are to be included within the definition of the term space object. The size and use of the space object is not legally presumed.¹⁴ Any object that reaches or is intended to reach outer space is to be considered a space object from the perspective of international space law.¹⁵

An asteroid or other NEOs are a natural occurrence. It can therefore hardly be considered a space object, especially as it is not being launched into outer space and for this very reason cannot be attributed to a launching state. No state ever launched or attempted to launch this object nor was it “designed” to be launched into outer space. It just happened to be there.¹⁶

Art VII OST contains no definition of what constitutes a damage, however, Art 1 lit a LIAB defines damage as *loss of life, personal injury or other*

10 Ibid.

11 Kerrest/Smith in: CoCoSL1, 128.

12 Kerrest/Smith in: CoCoSL1, 129.

13 Kerrest/Smith in: CoCoSL1, 139.

14 Kerrest/Smith in: CoCoSL1, 140.

15 Kerrest/Smith in: CoCoSL1, 141.

16 Ibid.

*impairment of health; or loss of or damage to property of states or of persons, natural or juridical, or property of international intergovernmental organizations.*¹⁷

The concept of damage as loss or *damnum* under general international law, be it physical injury or other consequences or injury, can be subsumed under Art VII OST.¹⁸

Causation of damage is *sine qua non* for liability. It is central to all compensation claims and a pre-requisite to impose liability on a state. Normally a direct causal link is needed to establish proof that the space object caused the particular damage.¹⁹

In our case, we are dealing with indirect damage – be it on Earth or in space. The proof of causation is rather difficult since not every damage emanating from a space object happens locally and immediately. Damage could be caused by a chain of events that are initiated by a space object, but they might emanate themselves not immediately or not in the same location.²⁰ While damage can occur as a consequence of a direct impact, damage could also be inflicted after an interval, an intervening event or events that are consequences of the initial “incident”.²¹ If such damage were to be considered damage resulting from a space object, it must be of such a kind that might not have occurred, had the space object (nuclear explosive device, kinetic impactor, gravity tractor...) not triggered the initial event, i.e. the destruction or deflection of the NEO. Such damage must be foreseeable but not too remote.²² As stated above, an asteroid or its remnants cannot be considered space objects, but a spacecraft equipped with a nuclear explosive device or a kinetic impactor or even a gravitational tractor may have set the events in motion that led to the damage. The actual damage may only appear sometime after the successful intercept of the asteroid. In order to trigger liability, the damage must be a result of the initial event caused by the planetary defence undertaking, even if subsequent or indirect. There are several legal notions such as damage that is foreseeable but not too remote, which are used to determine whether damage caused indirectly is included within the scope of the initial event.²³

If any planetary defence mission – destruction, deflection or redirection of an asteroid – leads to a damage, this may lead to the state (or states or

17 Ibid.

18 Ibid.

19 Ibid.

20 Kerrest/Smith in: Hobe Stephan /Bernhard Schmidt-Tedd/Kai-Uwe-Schrogl (eds), Cologne Commentary on Space Law, Vol. 2, Cologne 2013 (CoCoSL2), 126.

21 Kerrest/Smith in: CoCoSL2, 127.

22 Ibid.

23 Kerrest/Smith in: CoCoSL1, 142.

international organization) carrying out the mission being held liable for those damages under Art VII OST.

Liability under Art II LIAB might be triggered if damage occurred on Earth, in case a convincing causal chain of events can be established or verified that led to the damage originating from the original planetary defence operation. In order to hold a launching state liable for potential collateral damage caused by a planetary defence undertaking in space under Art III liability convention, the claimant has to prove that the launching state is at fault. Fault may be difficult to prove, however.²⁴

The very few experiences we currently have with damage in orbit show how complex such incidents actually are. Even a presumption of fault for activities in space is not easy to establish.²⁵

IV. Conclusion

Any mishap with a planetary defence undertaking or its unintended consequences may have the effect that the organizers of said undertaking are held liable for the related damages if those can be properly attributed to the planetary defence mission.

This attribution, however, is the actual crux of the matter. If damage is inflicted by a spacecraft, it may be possible to trace this spacecraft back to its operator and the launching state. If, let us say, the spacecraft carrying the kinetic impactor were involved in an accident, the applicability of the Liability Convention and of Art VII OST would be obvious. The more problematic question arises in the context of indirect damage. It is a far more difficult task to properly attribute such damage to a specific space activity.

To hold a state liable under Art III LIAB is even more complicated. The claimant has to prove that the damage is the specific state's fault. Optimistically and under the impression of long standing legal principles such as *in dubio pro reo* or *diligentia quam in suis*, one assumes that a state undertaking a planetary defence mission in order to save lives and property on our planet would act as professionally and delicately as possible in carrying out such an operation.

In this context, it is worth mentioning that the idea of a *Good Samaritan Law* has been floated in discussions about active space debris removal. Such an idea might also be interesting for planetary defence.

Nonetheless, damages caused by planetary defence operations might be of a much smaller scale than those that might be brought upon the planet in case of an impact event. The positive effects of successful asteroid impact mitigation would therefore largely outweigh the costs of liability under Art VII OST or the Liability Convention.

²⁴ Kerrest/Smith in: CoCoSL2, 135.

²⁵ Ibid.

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